

**WHAT IS CLAIMED**

1. A multiphase DC-DC converter comprising a plurality of DC-DC converter channels having outputs thereof combined at an output to provide a composite DC power output to a load, and wherein different ones of said channels have respectively different power conversion efficiencies and response times.

2. The multiphase DC-DC converter according to claim 1, where one or more of said channels have power conversion efficiencies that are greater than power conversion efficiencies of one or more others of said channels, and wherein said one or more others of said channels have response times that are higher than response times of said one or more of said channels.

3. The multiphase DC-DC converter according to claim 1, wherein a first of said channels has a higher power conversion efficiency than a second of said channels, and is operative to provide a leakage current component of the total output current supplied to said load by said converter, and wherein said second of said channels has a faster response time than said first of said channels and is operative to provide a dynamic current component other than said leakage current component of the total output current supplied to said load by said converter.

4. The multiphase DC-DC converter according to claim 3, wherein said first of said channels has a slower switching frequency than said second of said channels.

5. The multiphase DC-DC converter according to claim 4, wherein said first of said channels has a larger output inductance than said second of said channels.

6. The multiphase DC-DC converter according to claim 1, wherein a first of said channels has a higher power conversion efficiency than each of a plurality of other channels, and is operative to provide a leakage current component of the total output current supplied to said load by said converter, and wherein each of said plurality of other channels has a faster response time than said first of said channels and is operative to provide a dynamic current component other than said leakage current component of the total output current supplied to said load by said converter.

7. A method of supplying power to a load comprising the steps of:

(a) providing a multiphase DC-DC converter having a plurality of DC-DC converter channels, outputs of which are combined to provide a composite DC current to said load; and

(b) operating different ones of said channels at respectively different power conversion efficiencies and response times.

8. The method according to claim 7, wherein step (b) comprises

- operating a first of said channels at a higher power conversion efficiency than a second of said channels, and causing said first of said channels to provide a leakage current component of the total output current supplied to said load by said converter, and

- operating said second of said channels at a faster response time than said first of said channels, and causing said second of said channels to provide a dynamic current component other than said leakage current component of the total output current supplied to said load by said converter.

9. The method according to claim 8, wherein step (b) comprises operating said first of said channels at has a slower switching frequency than said second of said channels.

10. The method according to claim 9, wherein said first of said channels has a larger output inductance than said second of said channels.

11. The method according to claim 7, wherein step (b) comprises

- operating a first of said channels at a higher power conversion efficiency than each of a plurality of other channels, and causing said first channel to provide a leakage current component of the total output current supplied to said load by said converter, and

- operating each of said plurality of other channels at a faster response time than said first of said channels, and causing said plurality of other channels to provide a dynamic current component other than said leakage current component of the total output current supplied to said load by said converter.

12. A method of supplying power to a load comprising the steps of:

- (a) providing a multiphase DC-DC converter having a plurality of DC-DC converter channels with different power conversion efficiencies and response times, and outputs of which are combined to provide a composite DC current to said load;

- (b) causing a first of said channels, which has a relatively high power conversion efficiency and a relatively slow response time, to provide a leakage current component of the total output current supplied to said load by said converter, while maintaining second ones of said channels, which have relatively low power conversion efficiencies and relatively fast response times, in the off state; and

- (c) in response to a dynamic current demand by said load, causing said second ones of said channels to

provide a dynamic current component of the total output current supplied to said load by said converter, while causing said first of said channels to provide only said leakage current component of the total output current supplied to said load by said converter.

13. The method according to claim 12, wherein said first of said channels has a larger output inductance than said second ones of said channels.